In re Application of: Aharon J. AGRANAT et al
Serial No.: 10/566,264
Filed: April 17, 2007
Office Action Mailing Date: February 26, 2010

Examiner: CHANG Audrey Y.
Group Art Unit: 2872
Attorney Docket: 31316
Confirmation No.: 3491

REMARKS

Reconsideration of the above-identified application in view of the amendments above and the remarks following is respectfully requested.

Claims 1-28 and 30-41 are in this Application. Claims 1-23 have been withdrawn from consideration. Claims 24-41 have been rejected. Claim 29 has been canceled. Claims 1, 22, 24, 30, 32, 34, 35, 37 and 41 have been amended herewith.

35 U.S.C. § 112 Rejections

The Examiner states that the phrase "for particular application" is confusing and indefinite. Examiner's rejection is moot. The current claims do recite this phrase.

The Examiner states that the phrase "determining a birefringence grating" is confusing since it is not clear what physical structure, and what properties needed to be determined in order to form the birefringence grating. The Examiner raises similar rejection also with respect to the phrase "determining a concentration grating."

Examiner's rejection is respectfully traversed. It is submitted that a "grating" is a standard nomenclature in the art of crystals which describes a property that has spatial periodicity. Thus, "birefringence grating" defines spatial periodicity of the birefringence, "concentration grating" defines spatial periodicity of the concentration, "dielectric constant grating" defines spatial periodicity of the dielectric constant, "phase-transition temperature grating" defines spatial periodicity of the phase-transition temperature, *etc*.

Nevertheless, in good faith for further prosecution, the term "birefringence grating" and the phrase "determining a birefringence grating," have been deleted from the claims, and clarification wordings regarding the concentration have been introduced into claims 24 and 41.

The Examiner states that it is not clear what is the structural relationship between the concentration grating and the birefringence grating, and that it is not clear how does the concentration even gives birefringence property.

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The rejection is respectfully traversed. It is firstly noted that Applicant is not required to provide structural relationship in a method claim. It is secondly noted that the fact that periodicity in the birefringence upon activation of electric field is ensured by a judicious selection of the ion concentration in the crystal was demonstrated by the present Inventors. It is noted that the specification describes that the concentration grating creates a grating in the phase-transition temperature, T_c, which at the paraelectric phase, yields a grating in the dielectric constant. The specification further describes that the application of a uniform electric field produces an induced polarization grating which in turn induces an electrically controlled birefringence grating through the electrooptic effect.

Thus, contrary to the Examiner's contention, the concentration effects a birefringence property.

The Examiner states that the scope of the claims is confusing since there is no logical and structural relationship between the "electrically controlled Bragg grating" and the "concentration grating" and/or the "birefringence grating".

The rejection is respectfully traversed. The term "Brag grating," as known in the art, refers to a volume phase grating and causes no confusion in the context of the claim since a crystal is a volumetric entity and a crystal with a birefringence property affects the phase of light passing through the crystal. Thus, once the birefringence property is stored in the crystal, it becomes a Brag grating. Furthermore, as demonstrated in the specification as filed (see, *e.g.*, pages 17-20) there is a logical relationship between the concentration and the birefringence. Nevertheless, to expedite prosecution of this case the terms "Brag grating" and "birefringence" has been deleted from claims 24 and 41.

It is noted, however, that the claims now define a relationship between the spatial modulation of ion concentration and spatial periodicity in the phase-transition temperature, as explained in great details throughout the specification as filed (see *e.g.*, page 4 lines 12-14, page 13 lines 18-20, and page 17 line 10 to page 20 line 11.

The Examiner states that it is not clear how the "growth solution" of claim 30 is related to the electro-optical crystal. The solution and its relation to the crystal is now recited in claim 24. The Examiner's rejection of claim 30 is, therefore, moot.

The Examiner states that it is not clear how the "growth crucible" recited in claims 32 and 34 is related to the crystal or growth method. Claims 32 and 34 as presently amended explicitly claim (that which has previous claimed implicitly) that the solution is heated in a crucible, thereby rendering moot the rejection with respect to these claims.

The Examiner states that it is not clear how in claims 35-37 the crystal could be rotated before the crystal is being grown. Claims 35and 37 as presently amended explicitly claim (that which has previous claimed implicitly) that the crystal or seed are rotated during the growth, thereby rendering moot the rejection with respect to claims 35-37.

In light of the above remarks and amendments, Applicant respectfully request withdrawal of the 112 rejections.

35 U.S.C. § 102 Rejections

Claims 24-41 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Magel *et al.* in view of Yiu et al.

The Examiner states that the Magel *et al.* reference teaches growing the single electro-optic crystal by periodically changing or modulating the growth rate, including periodically modulating the temperature and pulling rate. The Examiner acknowledges that the Magel *et al.* reference does not teach that the periodic structure formed in the electro-optic crystal by growth process is comprised of a birefringence grating, a concentration grating and/or an electrically controlled Bragg grating. The Examiner further states that the Yin *et al.* reference teaches holographically written Bragg grating in lithium niobate crystal and holds that it is well known in the art to form electrically-controlled Bragg grating in electro-optic crystal. The Examiner concludes that the claims are obvious over the combination of Magel *et al.* and Yiu *et al.*

The Examiner's rejection is respectfully traversed. Yiu does not provide what Magel lacks.

Claim 24 is directed to a method of permanently storing spatial periodicity in phase-transition temperature into an electro-optic crystal. The claim recites the feature that spatial modulation of ion concentration in the crystal effects spatial periodicity in the phase-transition temperature within the crystal. The claim further recites the feature that the crystal is grown on a crystal seed in a solution, under condition of temporal periodic modulation in the temperature of the seed.

Magel teaches how to create domains with alternating direction of the polarization in ferroelectric crystals (such as lithium niobate). This is relevant to ferroelectric crystals at the ferroelectric phase that has a spontaneous polarization, but does not address the issue of phase-transition in the crystal. It is emphasized that Magel growth technique includes growing crystals from a solid rod using a laser beam that melts a particular zone of the rod. This is substantially different from the claims in which a crystal is grown in a seed within the solution.

Yiu teaches how to generate a tunable Bragg grating inside an optical fiber by adding an addition cladding layer that is electro-optic. The grating, however, is electrically tuned but not electrically modulated. Namely, Yiu's grating changes the wavelength that it reflects as function of the applied field. Yiu does not teach any crystal growing technique. It is submitted that since Yiu teaches holographic writing, he implicitly teaches fabrication of Bragg grating by means of laser beams, similarly to Magel.

Both Magel and Yiu do not even hint at a process in which a crystal is grown on a crystal seed in a solution under condition of temporal periodic modulation in the temperature of the seed. Both Magel and Yiu are completely silent with respect to the paraelectric phase of the crystal and certainly with respect to spatial periodicity in the phase-transition temperature. Both Magel and Yiu are silent with respect to a process in which a crystal is grown such that its ion concentration has a periodic spatial modulation.

Thus, the combination of Magel and Yiu does not anticipate claim 24.

Claims 23-28 and 30-40 all depend from claim 24, and are therefore submitted to be allowable with that claim, apart from the further features set forth in the respective claims. It is nevertheless noted that many of these claims set forth even further distinguishing features.

Claim 41 is directed to a method of growing a crystal. The method comprises selecting a characteristic ion concentration pattern, seeding a crystal seed in a solution, and causing temporal periodic modulation in the temperature of the seed so as to grow a crystal on the seed and to produce the characteristic ion concentration pattern in the crystal.

Thus, the combination of Magel and Yiu does not anticipate claim 41, because neither Magel nor Yiu teaches a process in which a crystal is grown on a crystal seed in a solution under condition of temporal periodic modulation in the temperature of the seed, and because neither Magel nor Yiu teach a process in which a crystal is grown such that its ion concentration has a periodic spatial modulation.

Rejoinder

It is noted that claims 1 and 22 are product by process claims which include all the limitations of allowable claim 24. A rejoinder of claims 1 and 22 as well as claims 2-21 which depend directly or indirectly from claim 1 is respectfully requested in accordance with 37 CFR 1.104 once claim 24 is allowed.

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In view of the above amendments and remarks it is respectfully submitted that the claims are now in condition for allowance. A prompt notice of allowance is respectfully and earnestly solicited.

Respectfully submitted,

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Enclosure:

- Petition for Extension (Two Months)